

CLAIMS

1. A nitrogen ion implantation composition for combating glitching in an ion implantation system when nitrogen ion implantation is followed by another ion implantation operation susceptible to glitching when following the nitrogen ion implantation, the nitrogen ion implantation composition comprising nitrogen (N_2) dopant gas and a glitching-suppressing gas comprising one or more selected from the group consisting of NF_3 , N_2F_4 , F_2 , SiF_4 , WF_6 , PF_3 , PF_5 , AsF_3 , AsF_5 , CF_4 and other fluorinated hydrocarbons of C_xF_y ($x \geq 1$, $y \geq 1$) general formula, SF_6 , HF , COF_2 , OF_2 , BF_3 , B_2F_4 , GeF_4 , XeF_2 , O_2 , N_2O , NO , NO_2 , N_2O_4 , and O_3 , and optionally hydrogen-containing gas.
2. The nitrogen ion implantation composition according to claim 1, wherein the optional hydrogen-containing gas comprises one or more selected from the group consisting of H_2 , NH_3 , N_2H_4 , B_2H_6 , AsH_3 , PH_3 , SiH_4 , Si_2H_6 , H_2S , H_2Se , CH_4 and other hydrocarbons of C_xH_y ($x \geq 1$, $y \geq 1$) general formula and GeH_4 .
3. The nitrogen ion implantation composition according to claim 1 or claim 2, wherein the nitrogen (N_2) dopant gas constitutes greater than 50 volume percent (vol.%) of the nitrogen ion implantation composition.
4. The nitrogen ion implantation composition according to any preceding claim, wherein the glitching-suppressing gas is present in an amount of from 1 vol.% to 49 vol.% of the nitrogen ion implantation composition.
5. The nitrogen ion implantation composition according to any one of claims 1 to 3, wherein the glitching-suppressing gas is present in an amount of from 5 vol.% to 45 vol.% of the nitrogen ion implantation composition.
6. The nitrogen ion implantation composition according to any one of claims 1 to 3, wherein the glitching-suppressing gas is present in an amount in a range whose lower endpoint vol.% value is any of 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 18, 20, 22, 25, 28, 30, 32, 34, 35, 37, 38, 40, and whose upper endpoint vol.% value is greater than the lower endpoint value and is any of 4, 5, 6, 8, 10, 12, 15, 18, 20, 22, 25, 28, 30, 32, 34, 35, 37, 38, 40, 42, 44, 45, 47, 48, and 49.
7. The nitrogen ion implantation composition according to any preceding claim, wherein the glitching-suppressing gas comprises one or more selected from the group consisting of NF_3 ,

N₂F₄, F₂, SiF₄, WF₆, PF₃, PF₅, AsF₃, AsF₅, CF₄ and other fluorinated hydrocarbons of C_xF_y (x≥1, y≥1) general formula, SF₆, HF, COF₂, OF₂, BF₃, B₂F₄, GeF₄, and XeF₂.

8. The nitrogen ion implantation composition according to any preceding claim, wherein the glitching-suppressing gas comprises NF₃.

9. The nitrogen ion implantation composition according to any preceding claim, wherein the glitching-suppressing gas comprises oxidic gas.

10. The nitrogen ion implantation composition according to claim 9, wherein the oxidic gas comprises at least one selected from the group consisting of COF₂, OF₂, O₂, N₂O, NO, NO₂, N₂O₄, and O₃.

11. The nitrogen ion implantation composition according to claim 9 or claim 10, wherein the oxidic gas comprises O₂.

12. A gas supply package for supplying a nitrogen ion implantation composition to an ion implantation system, in which the gas supply package comprises a gas storage and dispensing vessel containing the nitrogen ion implantation composition according to any one of claims 1 to 11.

13. A gas supply kit for supplying a nitrogen ion implantation composition to an ion implantation system, wherein the gas supply kit comprises a first gas storage and dispensing vessel containing nitrogen (N₂) dopant gas, and a second gas storage and dispensing vessel containing a glitching-suppressing gas comprising one or more selected from the group consisting of NF₃, N₂F₄, F₂, SiF₄, WF₆, PF₃, PF₅, AsF₃, AsF₅, CF₄ and other fluorinated hydrocarbons of C_xF_y (x≥1, y≥1) general formula, SF₆, HF, COF₂, OF₂, BF₃, B₂F₄, GeF₄, XeF₂, O₂, N₂O, NO, NO₂, N₂O₄, and O₃.

14. The gas supply kit of claim 13, further comprising a third gas supply vessel containing hydrogen-containing gas.

15. The gas supply kit of claim 14, wherein the hydrogen-containing gas comprises one or more selected from the group consisting of one or more selected from the group consisting of H₂, NH₃, N₂H₄, B₂H₆, AsH₃, PH₃, SiH₄, Si₂H₆, H₂S, H₂Se, CH₄ and other hydrocarbons of C_xH_y (x≥1, y≥1) general formula and GeH₄.

16. The gas supply kit of claim 13, further comprising hydrogen-containing gas in mixture with the nitrogen (N₂) dopant gas in the first gas storage and dispensing vessel.

17. The gas supply kit of claim 13, further comprising hydrogen-containing gas in mixture with the glitching-suppressing gas in the second gas storage and dispensing vessel.

18. The gas supply kit of any one of claims 13 to 17, wherein the glitching-suppressing gas comprises one or more selected from the group consisting of NF₃, N₂F₄, F₂, SiF₄, WF₆, PF₃, PF₅, AsF₃, AsF₅, CF₄ and other fluorinated hydrocarbons of C_xF_y (x≥1, y≥1) general formula, SF₆, HF, COF₂, OF₂, BF₃, B₂F₄, GeF₄, and XeF₂.

19. A method of supplying gas for nitrogen ion implantation, comprising delivering such gas to an ion implantation system in a packaged form comprising at least one of:

(i) a gas supply package comprising a gas storage and dispensing vessel containing a nitrogen ion implantation composition comprising nitrogen (N₂) dopant gas and a glitching-suppressing gas comprising one or more selected from the group consisting of NF₃, N₂F₄, F₂, SiF₄, WF₆, PF₃, PF₅, AsF₃, AsF₅, CF₄ and other fluorinated hydrocarbons of C_xF_y (x≥1, y≥1) general formula, SF₆, HF, COF₂, OF₂, BF₃, B₂F₄, GeF₄, XeF₂, O₂, N₂O, NO, NO₂, N₂O₄, and O₃, and optionally hydrogen-containing gas, as a packaged gas mixture; and

(ii) a gas supply kit for supplying a nitrogen ion implantation composition to an ion implantation system, in which the gas supply kit comprises a first gas storage and dispensing vessel containing nitrogen (N₂) dopant gas, and a second gas storage and dispensing vessel containing a glitching-suppressing gas comprising one or more selected from the group consisting of NF₃, N₂F₄, F₂, SiF₄, WF₆, PF₃, PF₅, AsF₃, AsF₅, CF₄ and other fluorinated hydrocarbons of C_xF_y (x≥1, y≥1) general formula, SF₆, HF, COF₂, OF₂, BF₃, B₂F₄, GeF₄, XeF₂, O₂, N₂O, NO, NO₂, N₂O₄, and O₃, optionally wherein the gas supply kit further comprises hydrogen-containing gas in a third gas storage and dispensing vessel, or in one or more of the first and second gas storage and dispensing vessels.

20. The method of claim 19, wherein the hydrogen-containing gas in the gas supply package (i) comprises one or more selected from the group consisting of H₂, NH₃, N₂H₄, B₂H₆, AsH₃, PH₃, SiH₄, Si₂H₆, H₂S, H₂Se, CH₄ and other hydrocarbons of C_xH_y (x≥1, y≥1) general formula and GeH₄.

21. The method of claim 19, wherein the hydrogen-containing gas in the gas supply kit (ii) comprises one or more selected from the group consisting of H₂, NH₃, N₂H₄, B₂H₆, AsH₃, PH₃,

SiH₄, Si₂H₆, H₂S, H₂Se, CH₄ and other hydrocarbons of C_xH_y (x≥1, y≥1) general formula and GeH₄.

22. A method of combating glitching in an ion implantation system wherein nitrogen ion implantation operation in the ion implantation system is followed by another ion implantation operation that is glitching-susceptible, said another ion implantation operation optionally being arsenic ion implantation and/or phosphorus ion implantation, the method comprising ionizing a nitrogen ion implantation composition according to any one of claims 1 to 11, to generate nitrogen implant species for the nitrogen ion implantation operation.

23. A nitrogen ion implantation method, comprising ionizing a nitrogen ion implantation composition according to any one of claims 1 to 11 to generate nitrogen ion implant species, and implanting the nitrogen ion implant species in a substrate.

24. The method of claim 23, wherein the implanting comprises directing a beam of the nitrogen ion implant species at the substrate.

25. Use of an ion implantation composition, gas supply package, or gas supply kit according to any one of claims 1 to 18 for the purpose of combating glitching in an ion implantation system wherein nitrogen ion implantation operation in the ion implantation system is followed by another ion implantation operation susceptible to glitching, optionally arsenic ion implantation and/or phosphorus ion implantation.

26. A packaged gas mixture comprises a gas storage and dispensing vessel containing the nitrogen gas mixture comprising nitrogen (N₂) dopant gas and a glitching-suppressing gas comprising one or more selected from the group consisting of NF₃, N₂F₄, F₂, SiF₄, WF₆, PF₃, PF₅, AsF₃, AsF₅, CF₄ and other fluorinated hydrocarbons of C_xF_y (x≥1, y≥1) general formula, SF₆, HF, COF₂, OF₂, BF₃, B₂F₄, GeF₄, XeF₂, O₂, N₂O, NO, NO₂, N₂O₄, and O₃, and optionally hydrogen-containing gas.

27. The packaged gas mixture according to claim 26, wherein the optional hydrogen-containing gas comprises one or more selected from the group consisting of H₂, NH₃, N₂H₄, B₂H₆, AsH₃, PH₃, SiH₄, Si₂H₆, H₂S, H₂Se, CH₄ and other hydrocarbons of C_xH_y (x≥1, y≥1) general formula and GeH₄.

28. The packaged gas mixture according to claim 26, wherein the nitrogen (N₂) dopant gas constitutes greater than 50 volume percent (vol.%) of the nitrogen ion implantation composition.

29. The packaged gas mixture according to claim 26, wherein the glitching-suppressing gas is present in an amount of from 1 vol.% to 49 vol.% of the nitrogen ion implantation composition.

30. The packaged gas mixture according to claim 26, wherein the glitching-suppressing gas is present in an amount of from 5 vol.% to 45 vol.% of the nitrogen ion implantation composition